

**Part 1 General**

**1.1 RELATED SECTIONS**

- .1 Section 31 23 10 - Excavation, Trenching and Backfilling.
- .2 Section 32 11 23 - Aggregate Base Course.

**1.2 REFERENCES**

- .1 American Society for Testing and Materials (ASTM International)
  - .1 ASTM A48/A48M-03, Standard Specification for Gray Iron Castings.
  - .2 ASTM C478-08, Specification for Precast Reinforced Concrete Manhole Sections.
  - .3 ASTM D698-07e1, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft<sup>3</sup>(600 kN-m/m<sup>3</sup>)).
- .2 Ontario Provincial Standard Drawings (OPSD)
  - .1 OPSD 401.01 (November 2013) – Cast Iron, Square Frame with Circular Closed or Open Cover for Maintenance Holes.
  - .2 OPSD 405.020 (November 2013) – Maintenance Hole Steps Solid
  - .3 OPSD 701.010 (November 2009) – Precast Concrete Maintenance Hole 1200mm Diameter.
  - .4 OPSD 701.021 (November 2013) – Maintenance Hole Benching and Pipe Opening Details.
  - .5 OPSD 701.030 (November 2009) – Precast Concrete Maintenance Hole Components 1200mm Diameter Tapered Top and Flat Cap.
  - .6 OPSD 701.031 (November 2009) – Precast Concrete Maintenance Hole Components 1200mm Diameter Riser and Monolithic Base.
  - .7 OPSD 704.010 (November 2009) – Precast Concrete Adjustment Units for Maintenance Holes, Catch Basins, and Valve Chambers.
  - .8 OPSD 704.011 (November 2008) – High Density Polyethylene Adjustment Units for Maintenance Holes, Catch Basins, and Valve Chambers.
  - .9 OPSD 708.020 (November 2011) – Support for Pipe at Catch Basin or Maintenance Hole.
- .3 Ontario Provincial Standard Specifications (OPSS)
  - .1 OPSS 404 –November 2010, Construction Specification for Maintenance Hole, Catch Basin, Ditch Inlet, and Valve Chamber Installation.
  - .2 OPSS 1351-November 2010, Material Specification For Precast Reinforced Concrete Components for Maintenance Holes, Catch Basin, Ditch Inlet And Valve Chambers.
  - .3 OPSS 1853-November 2007, Material Specification For Rubber Adjustment Units for Maintenance Holes, Catch Basin, Ditch Inlet And Valve Chambers.

- .4 OPSS 1854-April 2014, Material Specification For High Density Polyethylene Adjustment Units for Maintenance Holes, Catch Basin, Ditch Inlet And Valve Chambers.

## **Part 2 Products**

### **2.1 MATERIALS**

- .1 Precast manhole units:
  - .1 1200mm diameter maintenance holes:
    - .1 Circular to ASTM C478 and OPSD 701.010,
      - .1 Storm Manholes: complete with 300mm sump as per OPSD 701.010.
      - .2 Sanitary Manholes: Benching as per OPSD 701.021.
    - .2 Top section: flat slab top type with opening offset for vertical ladder installation to OPSD 701.030.
    - .3 Components: to OPSD 701.031, ASTM C478 and OPSS 1351.
  - .2 Joints: to be made watertight using rubber rings.
  - .3 Ladder rungs: to OPSD 405.020.
  - .4 Adjusting rings: to ASTM C478, OPSD 704.010 or OPSD 704.011, OPSS 1853 and OPSS 1854.
  - .5 Frames, gratings, covers to dimensions as indicated and following requirements:
    - .1 Metal gratings and covers to bear evenly on frames. A frame with grating or cover to constitute one unit. Assemble and mark unit components before shipment.
    - .2 Gray iron castings: to ASTM A48/A48M, strength class 30B.
    - .3 Castings: coated with two applications of asphalt varnish.
    - .4 Manhole frames and covers:
      - .1 Storm Sewer:
        - .1 In lawn and paved areas: Type B open cover cast with perforations and complete with two 25 mm square lifting holes to OPSD 401.010.
- .2 Granular bedding : Granular base material in accordance with Section 32 11 23 - Aggregate Base Course

## **Part 3 Execution**

### **3.1 EXCAVATION AND BACKFILL**

- .1 Excavate and backfill in accordance with Section 31 23 10 - Excavating Trenching and Backfilling and as indicated.
- .2 Obtain approval of Departmental Representative before installing, manholes.

### **3.2           INSTALLATION**

- .1     Construct units in accordance with details indicated, plumb and true to alignment and grade, in accordance with OPSS 407. Maximum relative difference between specified invert elevations not to exceed 10mm.
- .2     Complete units as pipe laying progresses.
- .3     Set precast concrete base on 150 mm minimum of granular bedding material compacted to 100% maximum density to ASTM D698.
- .4     Precast units:
  - .1       Make each successive joint watertight with Departmental Representative approved rubber ring gaskets.
  - .2       Plug lifting holes with precast concrete plugs set in cement mortar or mastic compound.
  - .3       Compact granular backfill to 95% maximum density to ASTM D698.
  - .4       Place frame and cover on top section to elevation as indicated. If adjustment required use concrete ring.
  - .5       Clean units of debris and foreign materials. Remove fins and sharp projections. Prevent debris from entering system.
  - .6       Refer to OPSD 708.020.

**END OF SECTION**

**Part 1 General**

**1.1 RELATED SECTIONS**

- .1 Section 01 21 00 – Allowances.
- .2 Section 03 30 05 - Cast-in-Place Concrete - Short Form.
- .3 Section 31 23 10 - Excavating, Trenching and Backfilling.
- .4 Section 32 11 23 – Aggregate Base Courses.

**1.2 REFERENCES**

- .1 American National Standards Institute/American Water Works Association (ANSI/AWWA).
  - .1 ANSI/AWWA C104/A21.4-95, Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water.
  - .2 ANSI/AWWA C111/A21.11-00, Rubber-Gasket Joints for Ductile-Iron and Gray Iron Pressure Pipe and Fittings.
  - .3 ANSI/AWWA C150/A21.50-02, Thickness Design of Ductile-Iron Pipe.
  - .4 ANSI/AWWA C151/A21.51-02, Ductile-Iron Pipe, Centrifugally Cast, for Water.
  - .5 ANSI/AWWA C153/A21.53-00, Ductile-Iron Compact Fittings for Water Service.
  - .6 ANSI/AWWA C217-04, Petrolatum and Petroleum Wax Tape Coatings for the Exterior of Connections and Fittings for Steel Water Pipelines.
  - .7 ANSI/AWWA C502-94, Dry-Barrel Fire Hydrants.
  - .8 ANSI/AWWA C504-00, Rubber-Seated Butterfly Valves.
  - .9 ANSI/AWWA C509-94, Resilient-Seated Gate Valves for Water Supply Services.
  - .10 ANSI/AWWA C550-90, Protective Epoxy Interior Coatings for Valves and Hydrants.
  - .11 ANSI/AWWA C600-99 Installation of Ductile-Iron Water Mains, and Their Appurtenances.
  - .12 ANSI/AWWA C800-05, Underground Service Line Valves and Fittings.
  - .13 ANSI/AWWA C900-97, Polyvinyl Chloride (PVC) Pressure Pipe, and Fabricated Fittings, 4 Inch through 12 Inch (100 mm - 300 mm), for Water Distribution.
  - .14 ANSI/AWWA C905-08, Polyvinyl Chloride (PVC) Pressure Pipe, and Fabricated Fittings, 14 Inch through 48 Inch (350 mm - 1200 mm), for Water Transmission and Distribution.
  - .15 ANSI/AWWA C907-91, Polyvinyl Chloride (PVC) Pressure Fittings for Water – 4 in. through 8 in. (100mm through 200mm).
  - .16 AWWA Manual #17: Installation, Field Testing, and Maintenance of Fire Hydrants (M17), 3<sup>rd</sup> Edition, published January 1989.
- .2 American Society for Testing and Materials International, (ASTM)
  - .1 ASTM A36/A36M-05a, Standard Specifications for Carbon Structural Steel.

- .2 ASTM A 53/A 53M-06, Standard Specification for Pipe, Steel, Black and Hot Dipped, Zinc Coated, Welded and Seamless.
- .3 ASTM A325-00, Standard Specification for Structural Bolts, Steel, Heat Treated 120/105ksi Minimum Tensile Strength.
- .4 ASTM A512-96(2005), Standard Specification for Cold-Drawn Buttweld Carbon Steel Mechanical Tubing.
- .5 ASTM A536 (1999), Standard Specification for Ductile Iron Castings.
- .6 ASTM B62-02, Standard Specification for Composition Bronze or Ounce Metal Castings.
- .7 ASTM B88M-03, Standard Specification for Seamless Copper Water Tube.
- .8 ASTM C478-06b, Standard Specification for Precast Reinforced Concrete Manhole Sections Metric.
- .9 ASTM C578-06, Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation.
- .10 ASTM D698-00ae1, Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft (600 kN-m/m<sup>3</sup>)).
- .11 ASTM D 1621-04a, Standard Test Method for Compressive Properties of Rigid Cellular Plastics.
- .12 ASTM F593-02e2, Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs.
- .13 ASTM F1674-96, Standard Test Method for Joint Restrain Products for Use with PVC Pipe.
- .3 American Society of Mechanical Departmental Representatives (ASME)
  - .1 ASME B1.20.1 1983 (R2001), Pipe Threads, General Purpose (Inch).
- .4 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB-1.88-92, Gloss Alkyd Enamel, Air Drying and Baking.
- .5 Canadian Standards Association (CSA International)
  - .1 CSA B137 Series-05, Thermoplastic Pressure Piping Compendium. (Consists of B137.0, B137.1, B137.2, B137.3, B137.4, B137.4.1, B137.5, B137.6, B137.8, B137.9, B137.10, B137.11 and B137.12).
    - .1 CSA B137.3-02, Rigid Polyvinyl Chloride (PVC) Pipe for Pressure Applications.
- .6 City of Ottawa Master Specifications (MS) and Special Procedures (SP)
  - .1 M..S. No. MW-13.1 Valve Boxes and Chambers (March 2013)
  - .2 M. S. No. MW-19.9 Cathodic Protection (March 2011)
  - .3 S.P. No. F-4491 Commissioning of Watermains (March 2015)
  - .4 S.P. F-No. F-4494 Cathodic Protection of New Watermains and Fittings (March 2015)
- .7 Underwriters' Laboratories of Canada (ULC)
  - .1 CAN/ULC-S520-1991, Hydrants.
  - .2 ULC S-513-1978, Threaded Couplings for 1½ and 2½ Inch Fire Hose

- .8 Ontario Provincial Standard Drawings (OPSD)
  - .1 OPSD 402.030 (November 2009) – Cast Iron, Rectangular Frame with Two Piece Cover for Meter and Valve Chambers.
- .9 Ontario Provincial Standard Specifications (OPSS)
  - .1 OPSS 1351 (April 2010) Material Specification for Precast Reinforced Concrete Components for Maintenance Holes, Catch Basins, Ditch Inlets and Valve Chambers.
- .10 National Fire Protection Association (NFPA)
  - .1 NFPA 291 (2007): Recommended Practice for Fire Flow Testing and Marking of Hydrants

### **1.3 STANDARDS**

- .1 All water main materials and workmanship to be in accordance with City of Ottawa Standards. W refers to City of Ottawa Standard drawings.

### **1.4 MATERIAL CERTIFICATION**

- .1 Submit manufacturer's certification that pipe materials meet requirements of this section at least 1 week prior to commencing work. Include manufacturer's drawings, information and shop drawings where pertinent.

### **1.5 SHOP DRAWINGS**

- .1 Submit shop drawings in accordance with Section 01 00 10 - General Instructions.
- .2 Provide shop drawings for the following:
  - .1 Valve chambers.
  - .2 Meter chambers.
  - .3 T.V.S. Chamber.

### **1.6 PRODUCT DATA**

- .1 Submit product data in accordance with Section 01 00 10 - General Instructions.
- .2 Provide product data for the following:
  - .1 pipe
  - .2 fittings
  - .3 hydrants
  - .4 valves
  - .5 valve boxes
  - .6 frame and covers
  - .7 retaining and restraining rings and associated hardware
  - .8 cathodic protection
  - .9 bolt corrosion protection tape and paste

## **1.7 RECORD DRAWINGS**

- .1 Refer to Section 01 00 10 - General Instructions.

## **1.8 SCHEDULING OF WORK**

- .1 Schedule Work to minimize interruptions to existing services.
- .2 Submit schedule of expected interruptions to Departmental Representative for approval and adhere to interruption schedule as approved by Departmental Representative.
- .3 Notify Departmental Representative minimum of 72 h in advance of interruption in service.
- .4 Do not interrupt water service for more than 4 h and confine this period between 18:00 and 07:00 h local time unless otherwise authorized.
- .5 Notify fire department of any planned or accidental interruption of water supply to hydrants.
- .6 Provide "Out of Service" sign on hydrants not in use.

## **Part 2 Products**

### **2.1 PIPE**

- .1 For Open Cut Installation
  - .1 Polyvinyl chloride pressure pipe to AWWA C-900 and CSA B137.3 for pipe sizes 102, 152, 203, 254 and 305 mm and to AWWA C-905 for 400 mm, Pressure Class 150, DR 18, cast iron outside dimensions, blue in colour and supplied with gaskets.
    - .1 Approved for use by the City of Ottawa.
    - .2 Push-on joints as per AWWA C-111, complete with vulcanized synthetic rubber gaskets.
  - .2 For Trenchless Installation
    - .1 Fusible Polyvinyl chloride pressure pipe: to AWWA C900 for pipe sizes 305 mm diameter and less and to AWWA C-905 for 406 mm diameter pipe, Pressure Class 150, DR 18, cast iron outside dimensions, blue in colour.
    - .2 Joints to be fused.

### **2.2 SERVICE CONNECTIONS**

- .1 Building Services 100mm diameter and larger within 3.0m of building foundation:
  - .1 Ductile iron pipe: to ANSI/AWWA C151/A21.51, pressure class 52, cement mortar lined to ANSI/AWWA C104/A21.4, continuous length.
  - .2 Push-on joints as per AWWA C-111, complete with vulcanized synthetic rubber gaskets.
- .2 Meter chambers and water booster station within 6.0m of structures and extending into:
  - .1 Ductile iron pipe: to ANSI/AWWA C151/A21.51, pressure class 52, cement mortar lined to ANSI/AWWA C104/A21.4.

- .2 Push-on joints as per AWWA C-111, complete with vulcanized synthetic rubber gaskets.
- .3 Building Services 100mm diameter and larger beyond 3.0m of building foundation:
  - .1 Polyvinyl chloride pressure pipe to AWWA C-900 and CSA B137.3, Pressure Class 150, DR 18, cast iron outside dimensions, blue in colour and supplied with gaskets.
  - .2 Approved for use by the City of Ottawa.
  - .3 Push-on joints as per AWWA C-111, complete with vulcanized synthetic rubber gaskets.
- .4 For Building Services smaller than 100mm diameter:
  - .1 Copper piping: to ASTM B88M type K soft, annealed.
    - .1 Service saddles in accordance with City of Ottawa Standards.
    - .2 Service Post: to City of Ottawa Standards and W-35.
    - .3 Main stops shall be either plug or ball per AWWA C-800 and curb stops shall be ball valves in accordance with AWWA C-800.

## **2.3 FITTINGS**

- .1 Fittings:
  - .1 Short body ductile iron fittings: to AWWA C-153.
    - .1 Cement lined per AWWA C-104.
    - .2 Mechanical or push-on joint.
  - .2 PVC fittings to AWWA C907 and CSA B137.3
    - .1 Push-on joints

## **2.4 RESTRAINING AND RETAINING RINGS**

- .1 For use on PVC pipe:
  - .1 The restraining devices shall meet the minimum requirements of ASTM F1674, have a working pressure of 1035 kPa complete with minimum 2:1 safety factor.
  - .2 Retaining rings are to be designed for use with their respective pipe and fitting size and class. The restraint mechanism shall incorporate a series of machined serrations on the inside diameter of the clamping ring.
    - .1 The rings are to be manufactured from high quality ductile iron per ASTM A536, Grade 65-45-12.
    - .2 T-bolts, clamping bolts and nuts, type 304 stainless steel per ASTM F593.
    - .3 Approved for use by City of Ottawa
- .2 For use on Ductile Iron Pipe:
  - .1 The restraining devices shall have a working pressure of 1035 kPa complete with minimum 2:1 safety factor.
  - .2 Rings shall be designed for use on mechanical joint bell ends and tee head bolts in accordance with AWWA C-111/ANSI A21.11 and AWWA C-153/A21.53. The restraining grip mechanism shall be provided by wedges, a double set screw locking system, or 360° grip-ring.



- .3 The rings are to be manufactured from high quality ductile iron per ASTM A536, Grade 65-45-12.
- .4 T-bolts, clamping bolts and nuts, type 304 stainless steel per ASTM F593.
- .5 Approved for use by City of Ottawa.

## 2.5 COUPLINGS

- .1 Couplings designed to withstand a hydrostatic test pressure of 1035 kPa.
  - .1 Center Sleeve:
    - .1 Material:
      - .1 Steel sleeves - carbon steel as per ASTM A36/A53/A512, minimum yield strength of 207 MPa.
      - .2 Cast sleeves - ductile iron as per ASTM A536, grade 64-45-12.
      - .3 Finish: shop finish enamelled.
      - .4 Ends to be smooth inside surface for uniform gasket seating.
        - .1 Minimum lengths:
          - .1 203 mm pipe and smaller: 152 mm.
          - .2 305 mm pipe: 203mm.
          - .3 406 mm pipe : 228mm.
        - .2 End Rings: ductile iron to ASTM A536.
        - .3 Nuts and Bolts: type 304 stainless steel per ANSI/AWWA C-111/A21.115, 25 mm diameter.
        - .4 Gasket: grade 30 special compound rubber (SBR) recommended for water, salt solution, mild acids and bases with a temperature range between -40°C to +65°C.
        - .5 Approved for use by City of Ottawa.

## 2.6 VALVES

- .1 Valves to open clockwise.
- .2 Gate valves to ANSI/AWWA C509, resilient seated:
  - .1 Application - for use on all 102mm, 152 mm, 203mm, and 305 mm diameter water main.
  - .2 Approved for use by City of Ottawa.
  - .3 Material - cast iron or ductile iron, non-rising stem, complete with 50 mm square operating nut in the vertical position, standard O-ring type steam seal.
  - .4 Pressure rating - minimum 1380 kPa.
  - .5 Joints:
    - .1 Mechanical joint ends - bell socket, plain end, and gland to ANSI/AWWA C-111, complete with cast iron gland rings, steel alloy bolts, and gaskets.
    - .2 Push-on joint ends - to ANSI/AWWA C-111.
    - .3 Finish: Two part spray epoxy coating or a fusion bonded epoxy coating, factory applied to exterior and interior surfaces in accordance with ANSI/AWWA C-550.

- .3 Butterfly valves: to ANSI/AWWA C504, short body long body, class 1 MPa with mechanical flanged joints.

- .1 Application - for use on all 406 mm diameter water main.
  - .2 Approved for use by City of Ottawa.

## **2.7 VALVE BOXES**

- .1 Cast iron valve boxes: 130 mm screw type manufactured from good quality grey iron to City of Ottawa Standards.
- .2 Valve boxes to consist of six elements, base, bottom section, extension, top section, cap, and guide wheel, in accordance with City of Ottawa standard drawing number W-24

## **2.8 VALVE CHAMBERS**

- .1 Precast reinforced concrete, components in accordance with OPSS 1351 and ASTM C 478M, and the following City of Ottawa standard drawings:
  - .1 Base section to W-5.
  - .2 Chamber section to W-6.
  - .3 Adjustment units to W-9.
  - .4 For Gate Valves:
    - .1 Circular Chamber W-3.
    - .2 Top section to W-8.
  - .5 For Butterfly Valves:
    - .1 Circular chamber section to W-2.
    - .2 Top section to W-7.
- .2 Ladder rungs to be cast integral with unit; field installation not permitted.
- .3 Frame and cover:
  - .1 Manufactured from good quality grey iron and shall be solid with clean surfaces, free from scales, lumps, flaws, blow holes, or other defects. No plugging or filling of defects or other methods of correcting defects shall be permitted.
  - .2 Castings minimum tensile strength of 138 MPa.
  - .3 Castings to conform to dimensions of W-15 and W-16.
  - .4 Cover to be marked "WATER"
  - .5 Castings to be thoroughly coated with approved casting paint.

## **2.9 METER CHAMBERS**

- .1 Precast reinforced concrete units in accordance with OPSS 1351 and ASTM C 478M. Chamber to be City of Ottawa R4 designation as per W-13, W-14.1 and W-14.
- .2 Cast in place adjustment sections to fit frame and cover.
- .3 Inside headroom of chamber 2134mm, as shown on drawings.

- .4 Designed by a professional structural engineer and capable of withstanding all dead and live loads, including superimposed traffic loads.
- .5 Frame and cover to OPSD 402.03.

## **2.10 T.V.S. CHAMBER**

- .1 Comprised of precast reinforced concrete units as outlined in W11.1 and in accordance with:
  - .1 OPSS 1351,
  - .2 ASTM C 478M,
  - .3 City of Ottawa technical requirements of MW-13.1.
- .2 Dimension of chamber per W11, R-4 designation.
- .3 Precast top to W14.
- .4 Precast joint details to W14.1.

## **2.11 BALL VALVES**

- .1 Ball valves for use on test tees:
  - .1 Body and cap: cast high tensile bronze to ASTM B 62.
  - .2 Pressure rating: Class 125, 860 kPa steam, WP = 1.4 MPa WOG.
  - .3 Connections: Screwed ends to ANSI B1.20.1 and with hex shoulders
  - .4 Stem: tamperproof ball drive.
  - .5 Stem packing nut: external to body.
  - .6 Ball and seat: replaceable hard chrome solid ball and teflon seats.
  - .7 Stem seal: TFE with external packing nut.
  - .8 Operator: removable lever handle.

## **2.12 WALL SEALS**

- .1 Foundation wall seals: Modular casing seal. Model number, sizes, and number as recommended by manufacture and to approval of Departmental Representative.

## **2.13 HYDRANTS**

- .1 Post type hydrants: dry barrel, compression, open against pressure, dry top, three way type with two 64mm hose outlet nozzles and one 127mm pumper outlet nozzle.
- .2 Hydrants, to CAN/ULC-S520, ANSI/AWWA C-502, and approved for use by City of Ottawa.
- .3 Hydrant to open counter-clockwise.
- .4 Designed for a minimum working pressure of 1035 kPa.
- .5 The upper and lower barrels shall be ductile iron complete with breakable flange and breakable bolts.

- .6 Main valve: nominal diameter of valve opening shall be a minimum of 127 mm.
- .7 Drain valve: the hydrant is to be provided with a drain valve that closes as the main valve opens.
- .8 Inlet connection to be mechanical joint, 152mm bell at base of hydrant to ANSI/AWWA C-111/A21.11. The base configuration and mechanical joint to be designed to accept retaining/restraining devices for both AWWA C-150 CL 52 ductile iron pipe and ANSI/AWWA C-900, DR 18 PVC pipe hydrant leads.
- .9 Bury length: Type D of City of Ottawa Standards in accordance with W-19.
- .10 Hose outlet nozzle: 64 mm hose outlet nozzles conforming to ULC S-513 and approved for use by City of Ottawa.
- .11 Pumper Outlet Nozzle: approved for use by City of Ottawa.
- .12 Operator Nut: 32mm square, direction to open to be counter clockwise.
- .13 The hydrant is to be factory primed and finished painted. Hydrant finish paint: colour red, exterior enamel to CAN/CGSB-1.88.

#### **2.14 CATHODIC PROTECTION**

- .1 Anodes are to be attached to all new ductile iron fittings, ductile iron pipe, and valves. The size and type of anode to be in accordance with City of Ottawa Standards and W-39, W-40, W-41, and W-42, M. S. No. MW-19.9 and S.P. F-No. F-7093.

#### **2.15 BOLT CORROSION PROTECTION**

- .1 Anti-corrosion petrolatum paste, tape and mastic approved for use by City of Ottawa and in accordance with ANSI/AWWA C217.

#### **2.16 HYDROSTATIC TEES**

- .1 Ensure two test tees are provided in each valve chamber, upstream and downstream of the valve, as per W-34.
- .2 52mm diameter.

#### **2.17 PIPE BEDDING AND SURROUND**

- .1 Granular Base Material to Section 32 11 23 – Aggregate Base Course.

#### **2.18 GRANULAR BASE**

- .1 Granular Base Material to Section 32 11 23 – Aggregate Base Course.

#### **2.19 INSULATION**

- .1 Expanded polystyrene: to CAN/CGSB-51.20, Type 4, with 275 kPa compressive strength to ASTM D 1621, shiplapped edges, thickness as indicated.

**2.20 BACKFILL MATERIAL**

- .1 Type 1 Fill: in accordance with Section 31 23 10 - Excavating, Trenching and Backfilling.

**Part 3 Execution**

**3.1 PREPARATION**

- .1 Clean pipes, fittings, valves, hydrants, and appurtenances of accumulated debris and water before installation. Carefully inspect materials for defects to approval of Departmental Representative. Remove defective materials from site as directed by Departmental Representative.
- .2 Ensure pipes delivered to site are provided with end caps and tamper evident seals.
- .3 Only remove end caps immediately before pipe is to be installed.

**3.2 OPEN CUT TRENCH INSTALLATION**

- .1 Trenching
  - .1 Do trenching and excavating work in accordance with Section 02315 - Excavating Trenching and Backfilling.
  - .2 Trench depth to provide cover over pipe of not less than 2.4 m from finished grade, as shown on drawings.
  - .3 Open cut installation to be completed where indicated on drawings
- .2 Granular Bedding
  - .1 Place granular bedding material in uniform layers not exceeding 150 mm compacted thickness to depth of 150 mm below bottom of pipe.
  - .2 Do not place material in frozen condition.
  - .3 Shape bed true to grade to provide continuous uniform bearing surface for pipe.
  - .4 Shape transverse depressions in bedding as required to suit joints.
  - .5 Compact each layer full width of bed to at least 95% maximum density to ASTM D 698.
  - .6 Fill authorized or unauthorized excavation below design elevation of bottom of specified bedding in accordance with Section 31 23 10 - Excavating Trenching and Backfilling.
- .3 Pipe Installation
  - .1 Lay pipes to ANSI/AWWA C600 and manufacturer's standard instructions and specifications. Do not use blocks except as specified.
  - .2 Join pipes in accordance with ANSI/AWWA C600 and manufacturer's recommendations.
  - .3 Bevel or taper ends of PVC pipe to match fittings.
  - .4 Handle pipe by methods recommended by pipe manufacturer. Do not use chains or cables passed through pipe bore so that weight of pipe bears on pipe ends.

- .5 Lay pipes on prepared bed, true to line and grade. Ensure barrel of each pipe is in contact with shaped bed throughout its full length. Take up and replace defective pipe. Correct pipe which is not in true alignment or grade or pipe which shows differential settlement after installation greater than 10mm in 3 m.
  - .6 Face socket ends of pipe in direction of laying. For mains on a grade of 2% or greater, face socket ends up-grade.
  - .7 Do not exceed permissible deflection at joints as recommended by pipe manufacturer.
  - .8 Keep jointing materials and installed pipe free of dirt and water and other foreign materials. Whenever work is stopped, install a removable watertight bulkhead at open end of last pipe laid to prevent entry of foreign materials.
  - .9 Position and join pipes with equipment and methods approved by Departmental Representative.
  - .10 Cut pipes in an approved manner as recommended by pipe manufacturer, without damaging pipe or its coating and to leave smooth end at right angles to axis of pipe.
  - .11 Align pipes carefully before jointing.
  - .12 Install gaskets to manufacturer's recommendations. Support pipes with hand slings or crane as required to minimize lateral pressure on gasket and maintain concentricity until gasket is properly positioned.
  - .13 Avoid displacing gasket or contaminating with dirt or other foreign material. Gaskets so disturbed or contaminated shall be removed, cleaned, lubricated and replaced before jointing is attempted again.
  - .14 Complete each joint before laying next length of pipe.
  - .15 Minimize deflection after joint has been made.
  - .16 Apply sufficient pressure in making joints to ensure that joint is completed to manufacturer's recommendations.
  - .17 Ensure completed joints are restrained by compacting bedding material alongside and over installed pipes or as otherwise approved by Departmental Representative.
  - .18 When stoppage of work occurs, block pipes in an approved manner to prevent creep during down time.
  - .19 Recheck plastic pipe joints assembled above ground after placing in trench to ensure that no movement of joint has taken place.
  - .20 Do not lay pipe on frozen bedding.
- .4 Pipe Surround:
- .1 Upon completion of pipe laying and after Departmental Representative has inspected work in place, surround and cover pipes as indicated.
  - .2 Hand place surround material in uniform layers not exceeding 150 mm compacted thickness as indicated.
  - .3 Place layers uniformly and simultaneously on each side of pipe.
  - .4 Compact each layer from pipe invert to pipe spring line to 95% maximum density to ASTM D 698.

- .5 From pipe springline to 300 mm above top of pipe hand tamp material. Do not use mechanical tampers directly over pipe where cover is less than 300 mm. .
- .5 Backfill remainder of trench.

### **3.3 TRENCHLESS INSTALLATION**

- .1 Directional Drilling
  - .1 Install pipe by directional drilling methods in accordance with Section 31 23 10 - Excavating Trenching and Backfilling.
  - .2 Handle pipe using methods approved by Departmental Representative and in accordance with manufacturer's installation instructions. Do not use chains or cables passed through pipe bore so that weight of pipe bears on pipe ends.
  - .3 Lay and join pipes in accordance with manufacturer's recommendations and to approval of Departmental Representative.
    - .1 Prior to joining, ensure pipe joints are protected from the elements and at the appropriate temperature in accordance with manufacturer's installation procedures.
    - .2 Ensure pipe manufacture representative is on site to witness the pipe fusing.
    - .3 Pipe joints to be true to alignment and have uniform roll-back bead.
    - .4 Allow joint to cool sufficiently, as recommended by pipe manufacturer, prior to removal of jointing pressure.
    - .5 Joints to be inspected and approved by Departmental Representative prior to insertion.
    - .6 Do not exceed maximum pipe deflection recommend by pipe manufacturer.
- .2 Jack and Bore Pipe Installation
  - .1 Install pipe by jacking and boring methods in accordance with Section 31 23 10 - Excavating Trenching and Backfilling.
  - .2 Handle pipe using methods approved by Departmental Representative and in accordance with manufacturer's installation instructions. Do not use chains or cables passed through pipe bore so that weight of pipe bears on pipe ends.
  - .3 Pipe joints to be fused in accordance with Directional Drilling installation.
- .3 Pipe Ramming Installation
  - .1 Install pipe by pipe ramming methods in accordance with Section 31 23 10 - Excavating Trenching and Backfilling.
  - .2 Handle pipe using methods approved by Departmental Representative and in accordance with manufacturer's installation instructions. Do not use chains or cables passed through pipe bore so that weight of pipe bears on pipe ends.
  - .3 Pipe joints in accordance with Section 31 23 10 - Excavating Trenching and Backfilling.
- .4 Rock Bore Installation
  - .1 Install pipe by rock bore methods in accordance with Section 31 23 10 - Excavating Trenching and Backfilling.

- .2 Handle pipe using methods approved by Departmental Representative and in accordance with manufacturer's installation instructions. Do not use chains or cables passed through pipe bore so that weight of pipe bears on pipe ends.
- .3 Pipe joints in accordance with Section 31 23 10 - Excavating Trenching and Backfilling.

### **3.4 INSULATION**

- .1 Install insulation in accordance with W-23.

### **3.5 VALVE INSTALLATION**

- .1 Install valves to manufacturer's recommendations at locations as indicated.
- .2 Support valves located in valve boxes or valve chambers by means of concrete blocks, located between valve and solid ground. Bedding same as adjacent pipe. Valves not to be supported by pipe

### **3.6 VALVE CHAMBERS**

- .1 Use precast units as approved by Departmental Representative.
- .2 Construct units as indicated, plumb and centered over valve nut, true to alignment and grade, and not resting on pipe.
  - .1 For Gate Valves, Refer to W-3.
  - .2 For Butterfly Valves, Refer to W-2.
- .3 Set precast concrete bases on 150mm minimum compacted granular base material.
- .4 Set chamber section of precast unit on top of precast bases.
- .5 Set precast top section over chamber section.
- .6 Install adjustment units over valve chamber precast top. Set frame and cover directly on adjustment units. Do not use shims.
- .7 Plug lifting holes with precast concrete plugs set in cement mortar.
- .8 Place frame and cover on top section to elevation indicated. If adjustment is required use concrete ring.
- .9 Clean valve chambers of debris and foreign materials; remove fins and sharp projections.

### **3.7 METER CHAMBER**

- .1 Install meter chamber as indicated, on minimum 150 mm compacted granular base material.

### **3.8 WATER MAIN CROSSINGS**

- .1 Prior to undertaking a crossing, daylight existing utility by means of vacuum excavation to confirm utility elevation and location.



- .2 Provide the clearances as indicated.

### **3.9 VALVE BOXES**

- .1 Install as indicated to W-24.
- .2 Ensure valve boxes are centered over valve, vertical, and free of debris.

### **3.10 TEST TEES**

- .1 Install test tees complete with ball valves as indicated and to accommodate flushing and disinfection, refer to W-34.

### **3.11 SERVICE CONNECTIONS**

- .1 Install service lines complete with valves at locations shown in accordance with City of Ottawa Standards and W 33.
- .2 Install service as indicated.

### **3.12 HYDRANTS**

- .1 Install hydrants at locations as indicated.
- .2 Install hydrants in accordance with AWWA Manual of Practice and in conformance with City of Ottawa Standards. Refer to W18 and W-19.
- .3 Install 152 mm gate valve and cast iron valve box on hydrant service leads as indicated to be 152 mm and in accordance with W-19.
- .4 Handle hydrants with appropriate slings and harnesses to avoid damage to painted surfaces. Any damage to paint work is to be repaired to the satisfaction of the Departmental Representative.
- .5 Set hydrants plumb, with hose outlets parallel with edge of pavement or curb line, with pumper connection facing roadway and breakable flange set at elevation of between 50 - 100 mm above final grade.
- .6 Restrain the hydrant lead at the tee connection to the main, on both sides of the valve, and at the base connection of the hydrant. In addition provide a concrete thrust block as indicated in W-19 against undisturbed soil.
- .7 Ensure the drain holes are kept open and surrounded with clear stone.
- .8 Place appropriate sign on installed hydrants indicating whether or not they are in service during construction.

### **3.13 RESTRAINED JOINTS**

- .1 Restrain joints at all bends, tees, and valves in accordance with W-25.5 and W-25.6.

**3.14 CATHODIC PROTECTION**

- .1 All fittings are to be provided with cathodic protection in accordance with W-39, W-40, W-41, and W-42.

**3.15 BOLT CORROSION PROTECTION**

- .1 Liberally apply anti-corrosion petrolatum paste tape and mastic to all exposed nuts and bolts.

**3.16 TRACER WIRE**

- .1 Install tracer wire in accordance with W-36.

**3.17 BACKFILL**

- .1 Refer to Section 31 23 10 - Excavating, Trenching, and Backfilling.

**3.18 HYDRANT FLOW TESTS**

- .1 Undertake fire flow tests as per AWWA Manual M17 at each hydrant upon completion of installation, witnessed by Departmental Representative. Notify Departmental Representative, a minimum of 48hours in advance prior to undertaking test.

**3.19 PAINTING OF HYDRANTS**

- .1 After installation, touch up factory applied paint to satisfaction of Departmental Representative.
- .2 Paint hydrant caps and bonnets in accordance with NFPA 291 based on flow test results.

**3.20 SWABBING**

- .1 All new water main sections 102mm to 305mm in diameter and 20m or longer in length shall be cleaned by swabbing in advance of performing hydrostatic and leakage testing.
- .2 All swabbing operations are to be in accordance with technical requirements of City of Ottawa Standard S.P. No. F-4491.
- .3 Contractor responsible for all costs associated with swabbing operations, including supply and installation of launchers, catchers, installation of temporary piping and fittings and their removal, supply of potable water, pumping, and swabs.
- .4 A minimum of four (4) swabs must be drawn through the pipe section to be cleaned. Swabs are to be marked for proper identification and shown to Departmental Representative after swabbing. If condition of swabs after swabbing is unsatisfactory, additional swabs will be ordered to be past through the pipe at no additional cost to the contract.
- .5 All piping less than 102mm in diameter, as well as all piping less than 20m in length is to be cleaned manually to the approval of the Departmental Representative.

### **3.21 HYDROSTATIC AND LEAKAGE TESTING**

- .1 Do tests in accordance with City of Ottawa Standards F-7090-Commissioning of Watermains.
- .2 Provide labour, equipment and materials required to perform hydrostatic and leakage tests.
- .3 Notify Departmental Representative at least 24 h in advance of all proposed tests. Perform tests in presence of Departmental Representative.
- .4 When testing is done during freezing weather, protect hydrants, valves, joints and fittings from freezing.
- .5 Open valves.
- .6 Expel air from main by slowly filling main with potable water. Install corporation stops at high points in main where no air-vacuum release valves are installed. Remove stops after satisfactory completion of test and seal holes with plugs.
- .7 Remove joints, fittings and appurtenances found defective and replace with new sound material and make watertight.
- .8 Repeat hydrostatic test until all defects have been corrected and until leakage is within specified allowance for full length of watermain being tested.

### **3.22 FLUSHING AND DISINFECTING**

- .1 Flushing and disinfecting operations shall be undertaken by the City of Ottawa. Contactor will be responsible for obtaining and coordinating the services of the City of Ottawa. The contractor shall include all costs in the tender amount and compensate the city for all related flushing and disinfecting fees. Refer to Section 01 21 00.

### **3.23 CONNECTION TO CITY OF OTTAWA WATER MAIN**

- .1 The live tap connection to City of Ottawa St Joseph Boulevard Feeder Main is to be undertaken under the full-time supervision of the City of Ottawa Inspector.
  - .1 Comply with all City of Ottawa submission requirements, including permits.
  - .2 Coordinate and schedule this connection with the City of Ottawa.
  - .3 Only contractor`s approved by the City of Ottawa will be permitted to perform the live tap.
  - .4 Pay all City of Ottawa costs associated with this work.

### **3.24 T.V.S. CHAMBER**

- .1 Install as indicated in W-11 on 150mm thick compacted granular base.
  - .1 Compact granular base to minimum 98% maximum density to ASTM D698.
- .2 Provide 50mm thick insulation in accordance with City of Ottawa MW-13.1.

**3.25 PURCHASE OF 203mm FIRE RATED WATER METER**

- .1 The contractor will be responsible for ordering and purchasing directly from the City of Ottawa the new 203mm Fire Rated Water Meter. The contractor will be responsible for pick up and delivery of the meter to the site from the City of Ottawa Clyde Avenue Depot. The contractor will be responsible for installation of the meter inside new chamber as detailed. The contractor will be responsible to compensate the City of Ottawa for all city costs associated with the purchasing, testing, and inspection of the meter installation. Refer to Section 01 21 00.

**END OF SECTION**

**Part 1 General**

**1.1 RELATED SECTIONS**

- .1 Section 31 23 10 - Excavating, Trenching and Backfilling.
- .2 Section 32 11 23 - Aggregate Base Course.

**1.2 REFERENCES**

- .1 American Society for Testing and Materials International, (ASTM)
  - .1 ASTM D698-07e1, Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft<sup>4</sup>-lbf/ft<sup>3</sup> (600 kN-m/m<sup>3</sup>)).
- .2 Canadian Standards Association (CSA International)
  - .1 CSA B1800-02, Plastic Non-pressure Pipe Compendium - B1800 Series (Consists of B181.1, B181.2, B181.3, B181.5, B182.1, B182.2, B182.4, B182.6, B182.7, B182.8 and B182.11).
    - .1 CSA B182.1-02, Plastic Drain and Sewer Pipe and Pipe Fittings.
    - .2 CSA B182.2-02, PVC Sewer Pipe and Fittings (PSM Type).
    - .3 CSA B182.11-02, Recommended Practice for the Installation of Thermoplastic Drain, Storm, and Sewer Pipe and Fittings.
- .3 Ontario Provincial Standard Specifications (OPSS)
  - .1 OPSS 409-November 2013 – Construction Specification For Closed-Circuit Television Inspection of Pipelines
- .4 City of Ottawa Special Provisions
  - .1 S.P. No. F4090 – Cleaning and Televising of Sewers.

**1.3 SUBMITTALS**

- .1 Submit product literature for storm sewer pipe and culverts in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Certification to be marked on pipe.

**Part 2 Products**

**2.1 OPEN CUT PIPE**

- .1 Plastic Pipe:
  - .1 Type PSM Polyvinyl Chloride (PVC): to CSA-B182.2.
  - .2 Standard Dimensional Ratio (SDR): 35.
  - .3 Locked-in gasket and integral bell system.
  - .4 Nominal lengths: 4 m.

## **2.2 PIPE BEDDING AND SURROUND MATERIAL OPEN CUT**

- .1 Granular base material: refer to Section 32 11 23 – Aggregate Base Course.

## **2.3 BACKFILL MATERIAL OPEN CUT**

- .1 Type 1 Fill: in accordance with Section 31 23 10 - Excavating, Trenching and Backfilling.

## **Part 3 Execution**

### **3.1 PREPARATION**

- .1 Clean pipes and fittings of debris and water before installation, and remove defective materials from site to approval of Departmental Representative.

### **3.2 OPEN CUT TRENCH INSTALLATION**

- .1 Trenching
  - .1 Do trenching Work in accordance with Section 31 23 10 - Excavating, Trenching and Backfilling.
  - .2 Do not allow contents of sewer or sewer connection to flow into trench.
  - .3 Trench alignment and depth to approval of Departmental Representative prior to placing bedding material and pipe.
- .2 Granular Bedding
  - .1 Place bedding in unfrozen condition.
  - .2 Place granular bedding material in uniform layers not exceeding 150 mm compacted thickness to depth as indicated up to spring line of pipe.
  - .3 Shape bed true to grade and to provide continuous, uniform bearing surface for pipe.
    - .1 Do not use blocks when bedding pipes.
  - .4 Shape transverse depressions as required suiting joints.
  - .5 Compact each layer full width of bed to at least 95 % maximum density to ASTM D698.
  - .6 Fill excavation below bottom of specified bedding adjacent to manholes or structures with compacted bedding material.
  - .7 Fill authorized or unauthorized excavation below design elevation of bottom of specified bedding in accordance with Section 31 23 10 - Excavating Trenching and Backfilling.
- .3 Pipe Installation
  - .1 Lay and join pipe in accordance with manufacturer's recommendations and to approval of Departmental Representative.
  - .2 Handle pipe-using methods approved by pipe manufacture.
    - .1 Do not use chains or cables passed through rigid pipe bore so that weight of pipe bears upon pipe ends.
  - .3 Lay pipes on prepared bed, true to line and grade with pipe inverts smooth and free of sags or high points.

- .1 Maximum allowable variation from indicated pipe invert elevations as measured at the manholes and catch basins not to exceed 10mm.
- .2 Ensure barrel of each pipe is in contact with shaped bed throughout its full length.
- .4 Begin laying at outlet and proceed in upstream direction with socket ends of pipe facing upgrade.
- .5 Do not exceed maximum joint deflection recommended by pipe manufacturer.
- .6 Do not allow water to flow through pipes during construction except as may be permitted by Departmental Representative.
- .7 Whenever Work is suspended, install removable watertight bulkhead at open end of last pipe laid to prevent entry of foreign materials.
- .8 Install plastic pipe and fittings in accordance with CSA B182.11.
- .9 Joints:
  - .1 Plastic pipe:
    - .1 Gaskets integral with pipe.
    - .2 Support pipes with hand slings or crane as required to minimize lateral pressure on gasket and maintain concentricity until gasket is properly positioned.
    - .3 Align pipes before joining.
    - .4 Maintain pipe joints free from mud, silt, gravel and other foreign material. Lubricate gaskets before jointing is attempted.
    - .5 Avoid displacing gasket or contaminating with dirt or other foreign material. Do not install pipes with damaged or disturbed gaskets.
    - .6 Complete each joint before laying next length of pipe.
    - .7 Minimize joint deflection after joint has been made to avoid joint damage.
    - .8 Apply sufficient pressure in making joints to ensure that joint is complete as outlined in manufacturer's recommendations.
- .10 When any stoppage of Work occurs, restrain pipes, to prevent "creep" during down time.
- .11 Cut pipes as required for special inserts, fittings or closure pieces, as recommended by pipe manufacturer, without damaging pipe or its coating and to leave smooth end at right angles to axis of pipe.
- .12 Make watertight connections to manholes ~~and catch basins~~.
- .13 Temporarily plug open upstream ends of pipes with removable watertight concrete, steel or plastic bulkheads.
- .4 Pipe Surround
  - .1 Place surround material in unfrozen condition.
  - .2 Upon completion of pipe laying, and after Departmental Representative has inspected pipe joints, surround and cover pipes as indicated.
  - .3 Hand place surround material in uniform layers not exceeding 150 mm compacted thicknesses as indicated.
    - .1 Do not dump material within 1 m of pipe.

- .4 Place layers uniformly and simultaneously on each side of pipe.
- .5 Compact each layer from pipe invert to mid height of pipe to at least 95 % maximum density to ASTM D698.
- .6 Compact each layer from mid height of pipe to underside of backfill to at least 90 % maximum density to ASTM D698.
- .5 Backfill
  - .1 Place backfill material in unfrozen condition.
  - .2 Place backfill material, above pipe surround, in accordance with Section 31 23 10 Excavating, Trenching and Backfilling, up to grades as indicated.

### **3.3 TESTING**

- .1 Repair or replace pipe, pipe joint or bedding found defective.
- .2 When directed by Departmental Representative, draw tapered wooden plug with diameter of 50 mm less than nominal pipe diameter through sewer to ensure that pipe is free of obstruction.
- .3 Remove foreign material from sewers and related appurtenances by flushing with water.
- .4 Television and photographic inspections:
  - .1 Carry out closed circuit television (CCTV) of installed sewers in accordance with the technical requirements of S.P. No. F4090.
  - .2 Submit one copy of CCTV inspection report to Departmental Representative for review. CCTV inspection report will be used by Departmental Representative in assessing acceptance of installed works.

**END OF SECTION**



**Part 1 General**

**1.1 RELATED REQUIREMENTS**

- .1 Section 03 10 00 – Concrete Formwork
- .2 Section 03 20 00 – Concrete Reinforcing
- .3 Section 03 30 00 - Cast-in-Place Concrete
- .4 Section 31 23 10 - Excavating Trenching and Backfilling.
- .5 Section 32 11 23 – Aggregate Base Course
- .6 Section 33 41 00 – Storm Utility Drains.

**1.2 REFERENCES**

- .1 American Society for Testing and Materials International (ASTM)
  - .1 ASTM D698-07e1, Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft<sup>3</sup>) (600kN/m<sup>3</sup>).
- .2 Canadian Standards Association (CSA International)
  - .1 CSA C22.2 NO. 211.1-06 (R2011) - Rigid Types EB1 and DB2/ES2 PVC Conduit.
- .3 Hydro Ottawa Engineering Specifications for the Installation of Civil Works for Underground Distribution No. GCS0005 – revision 6 2007-11-12.
  - .1 UCS0013: Two Way Pre-Cast Manhole 5 x 9.
  - .2 UCS0017: Manhole Drainage Detail.
  - .3 UCS0018: Collar Detail.
  - .4 UCS0020: Frame Detail.
  - .5 UCS0021: Cover Detail.
  - .6 UDS0005: Manhole Duct Termination – Construction Detail

**1.3 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
  - .1 Submit manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop Drawings:
  - .1 Submit shop drawings for precast manholes.
- .4 Manufacturer's Instructions: submit manufacturer's installation instructions and special handling criteria, installation sequence, and cleaning procedures.

**1.4 WASTE MANAGEMENT AND DISPOSAL:**

- .1 Separate waste materials for recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

**Part 2 Products**

**2.1 PVC DUCTS**

- .1 PVC ducts: 100mm diameter, type DB2 to CSA Standard C22.2 No. 211.1 encased in reinforced concrete.

**2.2 PVC DUCT FITTINGS**

- .1 Rigid PVC opaque solvent welded type couplings, bell end fittings, plugs, caps, adaptors as required to make complete installation.

**2.3 REINFORCING STEEL**

- .1 Reinforcing steel: refer to Sections 03 20 00 Concrete Reinforcing, size of bars as indicated.

**2.4 CONCRETE ENCASEMENT**

- .1 Concrete mixes and materials: to Section 03 30 00 – Cast-in-Place Concrete.

**2.5 GRANULAR BASE AND DUCT BANK SURROUND MATERIAL**

- .1 Granular base material: to Section 32 11 23 – Aggregate Base Course.

**2.6 PRECAST CONCRETE MANHOLES**

- .1 Pre-cast concrete manhole design loads and fabrication in accordance with Hydro Ottawa Standard Drawing UCS0013

**2.7 DRAINAGE**

- .1 Sump and drain fittings in each manhole consisting of back water valve, trap and pipe connection to drainage system, in accordance with Ottawa Hydro standard UCS0017.

**2.8 MANHOLE DRAIN STRAINER**

- .1 Precast Manhole Drain Strainer in accordance with Ottawa Hydro standard UCS0017.

**2.9 MANHOLE NECKS**

- .1 Precast collars in accordance with Hydro Ottawa Standard Detail Drawing UCS0018.

**2.10 MANHOLE FRAMES AND COVERS**

- .1 Cast iron manhole frames and covers in accordance with Hydro Ottawa Standard Drawing UCS0020 and UCS0021.

## **2.11 CABLE PULLING EQUIPMENT**

- .1 Pulling iron: galvanized steel rods, size and shape as per Hydro Ottawa Standard Drawing USC0013.
- .2 Pull rope: 6 mm stranded polypropylene, tensile strength 5 kN, continuous throughout each duct run with 3 m spare rope at each end.

## **Part 3 Execution**

### **3.1 MANUFACTURER'S INSTRUCTIONS**

- .1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheets.

### **3.2 INSTALLATION GENERAL**

- .1 Excavating, Trenching and Backfilling: refer to section 31 23 10 - Excavating Trenching and Backfilling
- .2 Install underground duct banks and manholes including formwork.
- .3 Build duct bank on compacted granular base material of not less than 150 mm thick, compacted to 95% of maximum proctor dry density in accordance with ASTM D698.
- .4 Open trench completely between manholes before ducts are laid and ensure that no obstructions will necessitate change in grade of ducts.
- .5 Install ducts with elevations indicated.
- .6 Install base spacers at maximum intervals of 1.5 m levelled to grades indicated for bottom layer of ducts.
- .7 Lay PVC ducts with configuration and reinforcing as indicated with preformed interlocking, rigid plastic intermediate spacers to maintain spacing between ducts as indicated.
  - .1 Stagger joints in adjacent layers at least 150 mm and make joints watertight.
  - .2 Encase duct bank with indicated concrete cover.
- .8 Make transpositions, offsets and changes in direction using long radius bends.
- .9 Use bell ends at duct terminations in manholes and pump station.
- .10 Use conduit to duct adapters when connecting to conduits.
- .11 Cut, ream and taper end of ducts in field in accordance with manufacturer's recommendations, so that duct ends are fully equal to factory-made ends.
- .12 Do concrete forming in accordance with Section 03 10 00 – Concrete Formwork.
- .13 Install steel reinforcing bars as indicated and in accordance with Section 03 20 00 – Concrete Reinforcing.
- .14 Place concrete in accordance with Section 03 30 00 - Cast-in-Place Concrete.
- .15 Allow concrete to attain 50% of its specified strength before backfilling.

- .16 Backfill sides of duct bank with granular base material compacted to 95% of maximum proctor dry density in accordance with ASTM D698.
- .17 For duct bank surround material use granular base material from top of duct bank to 300mm above, compacted to 90% of the maximum proctor dry density in accordance with ASTM D698.
- .18 Backfill remainder of trench as indicated.
- .19 Use anchors, ties and trench jacks as required to secure ducts and prevent moving during placing of concrete.
  - .1 Tie ducts to spacers with twine or other non-metallic material.
  - .2 Remove weights or wood braces before concrete has set and fill voids.
- .20 Clean ducts before laying:
  - .1 Cap ends of ducts during construction and after installation to prevent entrance of foreign materials.
- .21 Duct cleaning:
  - .1 Pull 300 mm long x diameter 6 mm less than internal diameter of duct wooden mandrel through each duct, immediately after placing of concrete.
  - .2 Then pull stiff bristle brush through duct; avoid disturbing or damaging ducts where concrete has not set completely.
  - .3 Pull stiff bristle brush through each duct immediately before pulling-in cables.
- .22 Install four 3 m lengths of 15M reinforcing rods, one in each corner of duct bank when connecting duct to walls.
  - .1 Wire rods to 15M dowels at walls and support from duct spacers.
  - .2 Place concrete down sides of duct bank filling space under and around ducts.
  - .3 Rod concrete with flat bar between vertical rows filling voids.
- .23 Install pull rope continuous throughout each duct run with 3 m spare rope at each end.

### **3.3 MANHOLES**

- .1 Install precast manholes.
- .2 Set precast manhole on a minimum 150mm thick compacted granular base material, refer to Section 32 11 23 – Aggregate Base Course.
- .3 Provide 115 mm deep window to facilitate cable bends in wall at each duct connection.
  - .1 Terminate ducts in bell-end fitting flush with window face.
  - .2 Provide four 15M steel dowels at each duct run connection to anchor duct run.
- .4 Alternately connect large duct runs by leaving square opening in wall, later pouring duct run and wall opening in one pour, and install 15M x 3m reinforcing rods in duct run at manhole connection.
- .5 Install manhole frames and covers for each manhole:
- .6 Drain floor towards sump with 1 to 48 slope minimum and install drainage fittings in accordance with Hydro Ottawa standard UCS0017

- .1 Install storm drain as indicated, refer to Section 33 41 00 – Storm Utility Drains.
- .7 Install anchor bolts and pulling irons as indicated.
- .8 Grout frames of manholes:
  - .1 Cement grout to consist of two parts sand and one part cement and sufficient water to form a plastic slurry.
- .9 Ensure filling of voids in joint being sealed.
  - .1 Plaster with cement grout, walls, ceiling and neck.
- .10 Backfill chamber in accordance with Section 31 23 10 - Excavating Trenching and Backfilling.
- .11 Spray paint "X" on ceiling of manhole above floor drain or sump pit.

### **3.4 FIELD QUALITY CONTROL**

- .1 Site Tests/Inspections:
  - .1 Inspection of duct will be carried out by Departmental Representative prior to placing.
  - .2 Placement of concrete and duct cleanout to be done when Departmental Representative present.

### **3.5 CLEANING**

- .1 Proceed in accordance with Section 01 74 11 - Cleaning.
- .2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

**END OF SECTION**